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F. A. WIRT, President — RAYMOND OLNEY, Secretary-Treasurer

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The Object and Scope of A. S. A. E. Activities

THE American Society of Agricultural Engineers was organized in December, 1907, at the University of Wisconsin by a group of instructors in agricultural engineering from several state agricultural colleges, who felt the need of an organization for the exchange of ideas and otherwise to promote the advancement of agricultural engineering. The object of the Society, as defined by the Constitution, is "to promote the art and science of engineering as applied to agriculture, the principal means of which shall be the holding of meetings for the presentation and discussion of professional papers and social intercourse, and the general dissemination of information by the publication and distribution of its papers, discussions, etc."

The membership of the Society represents all phases of agricultural engineering, including the educational, professional, industrial, and commercial fields.

The scope of the Society's activities embraces both the technical and economic phases of the application of engineering to agriculture, and is comprehended in the following general headings:

(a) Farm Power and Operating Equipment—power, implements, machines, and related equipment.

(b) Farm Structures—buildings and other structures and related equipment.

(c) Farm Sanitation—water supply; sewage disposal; lighting, heating, and ventilating of farm buildings, and related equipment.

(d) Land Reclamation—drainage, irrigation, land clearing, etc., and related structures and equipment.

(e) Educational—teaching, extension, and research methods, etc., employed in the agricultural engineering field.

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AGRICULTURAL ENGINEERING

The Journal of Engineering as Applied to Agriculture

RAYMOND OLNEY, Editor

Vol. 6 AUGUST, 1925 No. 8

EDITORIALS

A Desirable Pre-Requisite

NO less a personage than Theodore Roosevelt once made the statement that "Every man owes a part of his time to the upbuilding of the business or profession to which he belongs." On the strength of this, then, the agricultural engineer should devote constructive thought and a portion of his time to advancing the interests of his profession. The American Society of Agricultural Engineers is the agency through which the efforts of individual engineers to develop the profession generally can be made most effective.

No one is convinced of the necessity of devoting an unselfish effort to building up the profession, and the rewards that accrue from such efforts, so much as the agricultural engineer who has become a member of his national society and is then most active in supporting it, not only with money as represented in his membership dues, but also in taking a real part in the various activities of the organization.

Incidentally, it can be pointed out that the most outstanding men in the profession are those who have been most active in the affairs of their national society. Along with that activity has come a responsibility and in most cases sacrifices in the way of time and money to advance the interests of their profession through the national society which represents it, but these sacrifices have been offset many fold by the benefits they have received in putting their shoulder to the wheel to promote the general interests of the profession.

While membership in a national organization that represents one's profession is a privilege and an opportunity to advance one's own personal interests, it is likewise an obligation. The efforts that are being put forth by members of the American Society of Agricultural Engineers to develop their profession are resulting in many benefits to all members of the profession, and herein lies the obligation which the individual agricultural engineer should accept and join hands with those who, through the coordinated activities of the national society, are working hard to build up the profession.

It is the duty of members of the Society to encourage their associates and those with whom they come in contact in this field to consider membership in the Society. Many are going so far as to make membership in the American Society of Agricultural Engineers a prerequisite for their associates.

A case in point is that of Wendell P. Miller, an associate of the late Prof. F. W. Ives, who is a consulting agricultural engineer at Columbus, Ohio. His business had developed to the point where he wished to invite two of his men to become his associates. An important prerequisite, however, which he set down before taking this step, was to ask them to become membrs of A. S. A. E. He has made it a hard and fast rule that all engineers who are associated with him in the future shall be members of the Society.

Membership in a national society representing one's profession gives one a standing in his profession that is most important to his future advancement, and the sort of thing which Mr. Miller has done in encouraging his associates to become members of the Society should be carried out by agricultural engineers generally. This sort of thing will do two things: It will be an important factor in making greater progress in building up the profession and it will be a great help to the men individually who become members and take an active part in the organization work.

Fire Protection and Prevention

SHALL we allow the enormous annual farm fire loss of nearly $90,000,000 to remain a perpetual monument to American carelessness and irresponsibility? We, as agricultural engineers, are interested in the economic and financial aspect of American agriculture, and in the subject of fire prevention and fire protection we have a wide field and a definite need for our aid.

The fact that Pennsylvania farmers alone suffer an annual loss of nearly $3,000,000 comes as a severe shock to those who pride themselves upon their business, wisdom, and strength. This terrific waste is not only a matter of dollars but assumes a more serious economic nature. Livestock, feeds, and crops once destroyed cannot entirely be replacd by money alone. For example, the purebred livestock breeder who has a herd representing a score or more years of breeding may have all of his constructive work wiped out in a single blaze.

That very little attention has been paid to farm fires was evidenced by the replies received from a letter sent to the fire marshal of each state. With but few exceptions it was not possible to obtain any data whatsoever on this subject. Is it fair that the farmers who pay taxes to support such a department should receive so little attention from it? Undoubtedly not, but many replies stated that I was the first to request such information. The fire insurance companies are not philanthropic institutions and farm fire insurance rates are prohibitively high due to the unusual risk. Through an educational campaign and proper response and acceptance by the farmers we may reasonably expect a reduced premium due to reduced risk.

To make such a program effective is not a job for one man or for one department, but a task for our Society as a whole. It is criminal that there has been practically no work done to preserve life and property on the farms of these United States, and I believe that we can fulfill a definite need by outlining a program of action.

Fire prevention may be economically built into the farmstead by the proper arrangement of buildings so that a fire in one of them does not necessarily doom all to destruction. Scrap material, such as might otherwise be used for kindling may well be used as fire stopping, a cheap and effective preventative measure. The problem of fire prevention is concerned as well with buildings now existing. In these buildings we have the necessity of eliminating the defective flue, combustible roof, faulty wiring, and the careless storage of oils and combustibles.

While this is a new field it is one well worthy of our best endeavors. Shall we then aid the farmers in obtaining increased efficiency in production with no attention paid to increased protection?

The problem of fire protection on the farm is essentially an agricultural-engineering problem, and because of its importance more attention should be given to it in the future than it has had in the past. Agricultural engineers are realizing this fact and are beginning to devote constructive effort to it.

E. GRANT LANTZ

Grain Cleaners in Heavy Dockage Areas *

By Robert H. Black

Mem. A. S. A. E. In charge, Grain Cleaning Investigations, U. S. Department of Agriculture

THE average amount of dockage in spring sown wheat has been gradually increasing. In 1923 the average wheat dockage of North Dakota was 11.3 per cent, and over 15 per cent of the flax crop was dockage. North Dakota produced over 9,000 carloads of dockage, and Minnesota and South Dakota each produced nearly 2,000 carloads of dockage in 1923.

Much of the dockage can be removed from the grain and is valuable for feeding to livestock. The dockage from the wheat grown in the four states of Montana, North Dakota, South Dakota and Minnesota in 1923 was sufficient (with additional roughage) to have fed three and a half million lambs, adding weight to the lambs worth nearly nine million dollars. The 1924 crop of wheat was much cleaner than the average, but the yield of wheat per acre was much greater. In North Dakota the 1924 yield of wheat was 50 per cent greater than the ten year average. Although the average dockage per bushel was less in the 1924 crop, the number of bushels of wheat is so much greater that the actual number of bushels of dockage is greater than in 1923.

We thus have a crop or product in the central northwest with a potential farm value of nine million dollars annually, which is not converted into money for the farmers because no adequate machinery has been available for separating the dockage from the wheat before it leaves the farm.

The logical time and place for removing the dockage from wheat is during the threshing of the grain. For many years most of the weed seeds were removed from the grain by the use of sieves in the cleaner shoe of the separator. However, during the past twenty years, wild oats have become very common, and now it is almost impossible to remove many of the weed seeds by this method because the wild oats plug the holes in the sieves.

Experimental Cleaners

The U. S. Department of Agriculture has been experimenting for a number of years with various types of cleaners to be used in connection with threshing machines. The first cleaners used were of the fanning mill type, using sieves and air to accomplish the separations. These cleaners were placed on the decks of the threshers and were of both the end-shake and side-shake type. The side-shake type, in which gangs of sieves were used, were the least satisfactory because they were too complicated, required too much attention, and because the vibration of the separator gave them a very low efficiency. The end-shake deck cleaners, using all perforated metal sieves, were the most satisfactory when carefully watched by the operator. All of the deck cleaners were too complicated, and while good results can be secured by a careful operator, they were not practical for the average thresherman. A deck cleaner of simple construction can be built which will give fairly good cleaning results and will not require too much attention from the operator.

Other cleaners which were used on the deck of the threshers used disks, indented cylinders, and pure aspiration.

In 1921 the first successful cleaner was used on the deck of a small threshing machine in North Dakota. This experiment was conducted in cooperation with one of the threshing machine manufacturers and a grain cleaner manufacturer. In 1922 several cleaners of this type were in operation and three of them have continued in successful operation ever since. These cleaners were of the disk type. The principal objection to their use on the deck of the separator is that they make the separator top heavy because of the weight of the cleaner.

Portable Cleaners Used

In 1924 three types of portable cleaners were also used, a large fanning mill, portable disk cleaners, and portable cylinder cleaners. The portable fanning mill was one of the large deck cleaners which had been removed from the deck and placed on a truck and operated by a gasoline engine. This cleaner gave better satisfaction than when operated on the deck of the thresher, but because this type of cleaner is built for inside use, it was not suitable for outdoor use.

The portable disk cleaner used in 1924 was evolved from one used in 1923. This cleaner consists of a large disk cleaner with two elevators, and a gasoline engine. The disk cleaner contains two sets of disks mounted on two rotor shafts, enclosed in cylindrical casings. The grain to be cleaned is taken directly from the threshing machine and enters the first disk rotor which separates the wild oats from the wheat. The wild oats are discharged from the cleaner into one of the elevators and thence into a wagon box or sacks. The wheat and fine seeds are moved to the second rotor and the fine seeds removed from the wheat. The wheat is then elevated through the second elevator into wagon boxes or sacks. Eleven of these portable disk cleaners were in operation in the central northwest this year and the separations made were considered very efficient. The average dockage of all wheat fed into these portable disk cleaners was 11.7 per cent, and the average dockage in the clean wheat coming from these cleaners was 0.5 of 1 per cent. Less than 0.1 of 1 per cent of wheat was lost in the wild oats. The portable disk cleaner will be manufactured for general distribution this year.

The portable cylinder cleaner used in 1924 was evolved from the deck cylinder cleaner used in 1923. The portable cylinder cleaner consists of three indented cylinders, equipped with two elevators, and a gasoline engine, all mounted on a four-wheel truck. This cleaner was not ready for operation until late in the threshing season, but results secured during the short time it was observed indicate that it has commercial possibilities.

The portable type of cleaners are most satisfactory for cleaning grain in the heavy dockage areas because they can be used both at the time of threshing and afterwards. Some separations can also be made with portable cleaners which cannot be expected with any device which is part of the threshing separator.

Possibilities in Thresher Design

Several improvements can be made in present thresher design which will improve the cleaning done in the threshing machine. The present cleaning shoe of the thresher separator can be remodeled so that much better cleaning can be secured.

Nearly all cleaner shoes in threshers have various notches both in front and back for placing the sieves, including the chaffer and adjustable sieves. I have often seen sieves placed so that the travel of grain was decidedly up-hill. It is impossible to get a good separation by this method unless an angle sieve is used and because of the low capacity of the angle sieve, it is impracticable to use it in thresher work. The head end of the sieve should be stationary and the tail ends of the sieves only should be adjustable with an eccentric so that both sides of the sieve will be raised to the same height.

*Paper presented at the meeting of the Farm Power and Machinery Division of the American Society of Agricultural Engineers, Chicago, December, 1924.

Another thing about the present design of separator is that the small seeds like mustard and the smallest grain falls through the chaffer sieve or adjustable sieve first and onto the tail end of the fine seed sieve. By properly placing a blank between the adjustable sieve and the fine seed sieve all of the grain and small weed seed can be fed onto the upper end of the fine seed sieve, which will afford a greater opportunity for cleaning before the grain goes into the auger. The same result can be accomplished by lengthening the lower sieve.

Some method of cleaning the seed sieves of wild oats must be provided, otherwise the sieves will quickly clog and become inactive. There are several methods of doing this, the most satisfactory of which is utilized in the Johnson sieve, in which stationary wooden racks are provided which continually rub the bottom of the vibrating sieve.

Deck Cleaners

No successful device for removing wild oats and other coarse heavy dockage from wheat in the cleaning shoe has been found. The large amount of wild oats found in spring wheat suggests that an auxiliary deck cleaner is advisable for those threshers operating in districts infested with wild oats and similar coarse dockage, where portable cleaners are not available.

The principal difficulties encountered in operating the deck type of sieve and air cleaner, or fanning mill type, was that the recleaners were too complicated. As a result of the experiments which we have made with deck type cleaners, it is my opinion that a deck type cleaner can be built which will remove most of the dockage. It cannot be expected, however, to remove cockle without a wastage of wheat, nor can it be expected to clean the wheat to a dockage-free basis when large percentages of dockage are encountered.

The deck type of cleaner should be driven from the cylinder shaft. The practice of driving the cleaner from the fan shaft of the separator is not satisfactory.

The fan of the deck type cleaner should be run at a high rate of speed and must have protected inlets. If the fan can be divided into two or more sections, the wind separation will be improved.

In most areas, two or three sieves only in the cleaner are all that is necessary. The sieves should be provided with positive, simple cleaners so that the sieves will not clog.

The farmers in the heavy dockage areas are beginning to realize the value of feeding the grain screenings which they have produced in their grain. It is natural that they will demand machinery for removing the dockage before the grain leaves the farm. The results of our experiments have demonstrated that the screenings can be most economically removed as part of the threshing operation.

Discussion

Mr. Junkin: From Mr. Black's paper it is quite plain that the thresher engineer has not kept up with the times. The weeds have been growing while we have slept. There are several reasons why we have not kept up. The first and most important is that the thresher manufacturers have been very hard hit in the last few years and it has been hard to make ends meet financially. The trend has been to small machines. The labor to build a small machine is almost as much as to build a large one and because labor represents a big part of the cost, the profit has been small. On account of the small profit, the manufacturers have felt that very little money could be spent for experimental work, so the thresher has not been improved as it should have been.

Another reason is that the thresherman, threshing by the bushel, has wanted as many bushels to go through the weigher as possible, as that is the way he is paid. Many threshermen do not even try to use the screens furnished.

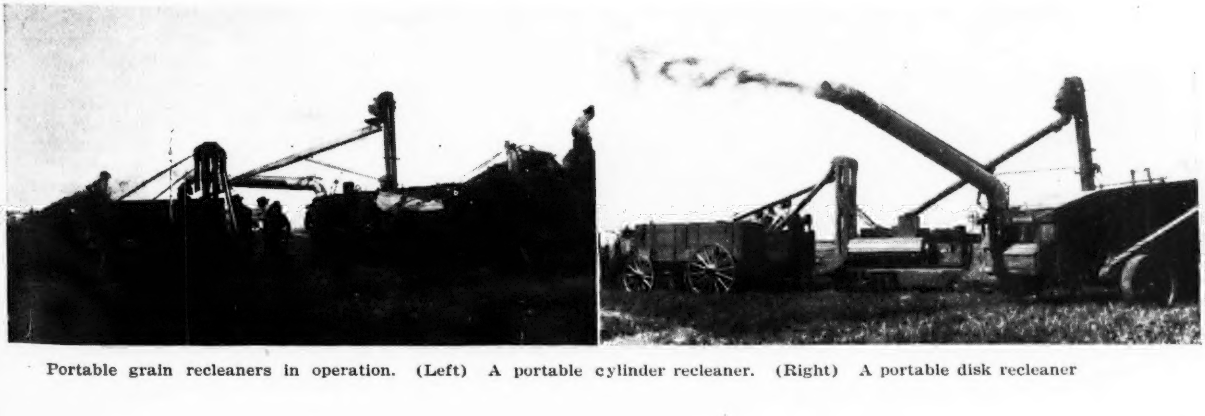
And still another reason is that when the farmer hauls his wheat to market, the elevator man makes a rough guess at the total amount of weed seeds and could not show the farmer the exact amount of dockage because he had no way to completely separate the sample.

But the Perkins dockage tester, a device recently developed, will show at once the amount of dockage. The dockage tester does with a small sample what is done commercially with mill separators. This will surely make the farmer realize that there is a big waste in failing to properly clean his grain at the thresher.

Whether it is done by the thresher itself or by a separate machine, I firmly believe that more attention must be given to improving the thresher so that the grain will be improved by taking out both the coarse and fine dockage. In the near future, the farmer will demand in the thresher itself or in a separate unit a means for cleaning his grain for market, for a loss such as given in Mr. Black's report means too much to go unnoticed.

Mr. Kranich: I was interested in the Perkins dockage tester primarily because I was in the Minneapolis grain inspection office one time, and saw them establishing the grade on wheat by hand. They had men picking the so-called inseparable weed seeds out by hand, which rather amused me, since a machine could be made which would eliminate picking it out by hand. It seemed to me there must be a big error, since it was all left to these men, forty or fifty of them, to pick out the weed seeds. The Perkins dockage tester, is doing what these men did by hand, and more than that, it raises the grade, and does it truly mechanically. The man in charge of the office told me it was raising the grade for the farmer, which meant considerably more income to him. That was what I got out of it. It was rather amusing to me, because mechanical means had been found to do what had been done by hand, and they thought it could not be done any other way.

Mr. Worthington: Dockage removal is one of the most serious things the thresher manufacturer is up against. He is up against it from several viewpoints. In the first place, the prosperity of the farmer, which in no small measure is dependent upon the amount of dockage present in the product which he sells which directly affects his buying power, and next, the prosperity of the manufacturer. The other great factor that he is up against is his own lack of knowledge of how to overcome these conditions. As the thresher manufacturer turns to the grain cleaner manufacturer for information, we find that they are not up



Portable grain recleaners in operation. (Left) A portable cylinder recleaner. (Right) A portable disk recleaner


(Left) Recleaning wheat from a thresher with a portable disk type recleaner. The man in the picture is shown shoveling mustard seed from under the cleaner. (Right) Flax in the shock showing a high percentage of wild oats

against the same conditions. For instance, a threshing machine out in the field handles all kinds of grain under all conditions of climate and all conditions of weather, and all conditions of the actual grain itself, as far as size and the percentage and kind of dockage present. That is a condition into which so many variables enter that it makes it exceedingly difficult to design and build a machine economically that will meet all these needs. I feel that in the past possibly the thresher manufacturers have not made available all of the information which they have had, not through any positive desire to keep this information secret, but because we never got together.

In regard to the matter of cleaning fans and cleaning sieves in separators, I know of one company that has spent a great deal of money in development work of this kind, which has never been made public, because the results were never carried out to conclusions that would withstand the great flood of opinion, and false opinions at that that are prevalent.

The crux of the matter is this, that it takes an awful lot of nerve to talk about subjects regarding which so very little is known, and I believe that the average manufacturer finds himself in about that position, as to just what will really constitute an effective cleaning device. To bear out that statement, we only need to turn to their catalogs and find out the great number of types of cleaning devices that are in use today, each of which claims to be the best and the most effective.

There are certain fundamental principles that make it almost impossible, I believe, at the present stage of the art, to say that dividing your blades will do any good, or using a five-blade fan or a 4-blade fan, or eliminating adjustments as to windboard. My own experience has been that an adjustable windboard will not direct the blast from that standpoint; I refer to changing the course of the blast. An adjustable windboard will effect an equal distribution of the blast, when the volume of air is reduced at a constant fan speed. The entire matter is to get an even distribution of the blast over the sieves, and an even distribution of the material over the sieves, and to pretty well forget what the other fellow is doing and what we have done ourselves in the past, and strike out along rather original lines.

The automotive industry furnishes us the greatest example perhaps of what may be done through cooperation. They have gone so far that they have pooled their patents and a new thing is hardly out of one company's laboratory and adopted into a current model before the other companies recognize it and adapt it to their product, and the whole art and the whole industry progresses accordingly. I really feel that this idea we have had, of each of us being a law unto ourselves, has been the greatest detriment that we, the manufacturers, have come up against as a class.

Mr. Black has attacked the problem from a far larger standpoint, and it is only through education of the farmer and the bringing to bear, you might almost say, of a demand from the field for an improved product, which will ultimately force, if I may use so strong a term as that, the manufacturer to develop the machines which we are capable of developing. In other words, the art of cleaning grain is one of the most undeveloped sciences that we have to contend with today. I have seen cleaning devices working in foreign countries that were positively so efficient that it would make you marvel, and I have seen in this country some wind cleaning or dockage removing devices operate on the pneumatic principle that were fully as effective as any disk cleaner I have ever watched in operation.

It is not so much a matter of the type of machine we adopt as it is taking some particular line and knowing what its capabilities and possibilities are, and then following out the development, if not to its ultimate end, to an end which will give us satisfactory results.

Mr. Morrissey: The question of wild oats has been very interesting to us as threshing machine experts and manufacturers, and we get it in some parts of the United States and some parts of Argentine and similar countries, and we are very much interested in this indented disk rotary cleaner. We have watched it in a number of cases. One particular reason why we are troubled with wild oats is that the wild oats get ripe and fall off the straw onto the ground before the farmer gets around to cut the wheat. Naturally he has a crop of oats started for the next year. I talked to a man about blowing too much wild oats about, and he took me around to a field where he had not cut yet, and he showed me a fine crop of wild oats started on the ground.

I had occasion to see one of these disk cleaners working with a 40x62 separator in South America. It was made by Marchesi Brothers. It was supposed to be copied from the Carter patents. They were using it as a portable machine, and were operating it with a tumbling shaft from the threshing machine. This machine was also equipped with a deck cleaner, so that when the threshing machine man struck jobs where there was a small percentage of wild oats, say five to ten per cent, he could use the deck recleaner. When he struck a large percentage of wild oats he would use the disk cleaner, and he got good results. The farmer could sell the seeds for one cent a pound, but as soon as he cleaned it he got about 2 cents a pound for the wheat and about one cent a pound for the oats. He increased his efficiency about 100 per cent by using that particular machine.

We find that there is a great difference between the United States and other countries. In the United States we have lots of elevators, and the threshing machine man is not particular to buy all of the attachments or sieves that go with the machine for cleaning the grain. The farmer depends on the elevator man to take care of his grain and sometimes to dry it, or reclean it. In other countries, where they have not got these elevators, where they just clean the grain up at the machine and ship it in sacks, probably on flat cars, they take more pains to get the chaff and small wheat seeds and wild oats out. To do that they have their cheat screen and deck recleaner and also the rotary screen with brush for cleaning. Some machines are equipped with all of these. In the United States this year we find, on the average, that half of the men that bought threshing machines did not want the cheat screen

for taking out small seeds. They'd rather have something else, some other kind of sieve for separating flax or millet.

Another thing about the separating of the small weed seeds from the grain is that the thresherman does not get paid for the small weed seeds. In the ports of Argentine, they have supplies of oats to mix with the grain; some of the dealers, when they get grain that is over grade mix the oats with it to bring it down to grade.

On the combined harvester-thresher it seems to me there is a very easy way of taking out the weed seeds, the small rotary weed screen with brush for keeping it clean. That is also used for separating flax from wheat and with very good results.

Mr. Mainland: For three or four years we have been very much interested in this question, and we started out by sending letters broadcast throughout the country, asking which kind of weed screen was required in that part of the country. Out of our first letters we did not get a single reply giving us information. They all said that they didn't know, or they did not use a weed screen. This year we were so much interested we made up three deck recleaners of the fanning mill type and furnished them, free of charge, to threshermen to try out.

These recleaners were not new as we had made them for a great many years for the Argentine trade and while they did not prove one hundred per cent satisfactory in the northwest territory, they did very materially change the condition of the wheat coming from the threshing machine. But the point I wish to bring out is that a custom thresher using this recleaner on his machine and threshing at the same price, per bushel, to the farmer as other threshers without recleaners simply had to take off the recleaner, because of the lack of interest of the farmers in getting clean wheat, and in some cases they even objected to having it recleaned, even when it was done without cost to them.

It seems there will have to be educational work done throughout the country before the manufacturer can do anything along this line because at the present time I believe that almost every manufacturer has some kind of recleaning apparatus more or less efficient but is unable to sell it as there is no demand for it. Anything done along this line at the present time must be of an educational nature as there is practically no demand for recleaners attached to threshing machinery.

We have been interested in the disk type of recleaner and have seen them work and thought them very efficient, but we know of a farmer in Canada who paid about $2,300 for his outfit thinking he could reclean the wheat he threshed. He said after trying it out he could use it for his own wheat and get very good results, but that it was an absolute failure when he tried to use it when threshing around the neighborhood. He reported that the time required to change the disks to suit the different kinds of wheat he had to thresh was prohibitive. In other words, different kinds of wheat required a change in the disks, and on this account the number of disks and the time in changing them prohibited his using this recleaner except on his own farm.

It seems to me while a recleaner can be made that will take care of any sample of wheat that needs recleaning, there has been no recleaner made, up to the present, that will take care of all the different conditions that may be encountered. While possibly the disk type of recleaner may come nearest to this, their cost is so great, it being more than all the rest of the thresher end of the outfit, that it makes it a very expensive machine to use in connection with a threshing rig.

The fanning mill recleaner is quite reasonable in cost, but requires a great deal of attention and adjustment to do good work, but it can be made to do practically all the recleaning that is necessary, except probably in wild oats and even in this we have tests that show they will take out up to ninety per cent of the wild oats in a sample, but this required very careful adjustment.

We believe the solution of this problem should be approached from an attempt to raise less dockage in the wheat rather than trying to remove it after it has been grown.

Mr. Grunwald: The discussions here today have been of peculiar interest to me. During my childhood and early manhood I was in close touch with farming in Russia-Poland, Russia, and Germany, and became well acquainted with the methods therein employed. This experience has enabled me to make some interesting comparisons in connection with the practices and in the use of farm machinery on farms in our western states.

In Europe farming is a mode of living employed by generations of the same families using the same lands for centuries. In America farming is engaged in by men of all classes, many of whom are entirely unfitted for the task. With the former the outlook is never away from the land, with the latter it is too often towards the city and farming is regarded simply as a step to a residence in the city or town. American farmers of this class naturally do not give the same careful consideration to soil preservation, to the improvement of stock and to the careful rotation and marketing of crops, which is general in European countries.

In the use of modern machinery the American farmer, of course, is far in advance of his European brother, American genius and invention have met and solved many of the problems of the farmer in this country, enabling him to produce in volume far in excess of the farmer abroad where cheap labor is abundant. I am convinced, however, that in some respects the American farmer and the manufacturer of agricultural machinery can learn something from a closer study of the mechanical devices in use abroad, and I beg your indulgence to mention one of these which comes to my mind at this moment.

In the threshing of European grain, many of the larger farmers use machinery made in England. This machine is equipped to thresh, sort, and clean the grain, and separate the straw. The grain is separated into three grades—1, 2 and 3; grade No. 1 being utilized for seed and also with No. 2 for marketing, and grade No. 3 comprising the broken and imperfect berry and also weed seeds is crushed and used for feeding purposes. In Europe use is made of all the straw which is chopped and mixed with crushed grain and weed seeds for roughage, or used as bedding, and later spread on the fields for fertilizer. I am convinced that this method results in giving the European farmer better and cleaner seed for planting, this insuring increased yields and less trouble with weeds. It assures him a larger amount of cheap forage and feed and also a large supply of manure.

I am pleased to note that the manufacturers of farm machinery are giving so much thought to the economic problems of the farmers. Their concern in these matters is sure to bring results of value and I am hopeful will check the growing tendency to precipitate these questions into the debates of Congress, with the usual resulting flood of impractical legislation. Such legislation, as is well known, has resulted in nothing of value in solving the difficulties.

Mr. Blauser: As pointed out by Mr. Black, there is a great loss annually in the spring wheat areas of Montana, North Dakota, South Dakota, and Minnesota, due to dockage. Some questions that occur to me along this line are these: What are the causes for such a high percentage of dockage, and how much would the value of the wheat crop be increased if the dockage produced could be materially reduced? When there is a typhoid fever epidemic, the first thing we do is to secure a doctor's services for those having the fever; then the next thing we do or should do is to locate the source of contamination, if it is caused by the water supply, and prevent new cases from developing by removing the cause.

It seems that the question of dockage may be a parallel case. And perhaps we should spend some time in trying to determine the causes for the heavy dockage in these areas, and then see if it is not possible to decrease it.

The main causes for heavy dockage are sowing uncleaned seed and the particular methods of farming. Samples taken from drills in the field showed that seed wheat was being used, which contained as much as eighteen per cent dockage. There should be no excuse for using that quality of wheat for seed. The agricultural experiment station of South Dakota State College has records that show the yield of wheat in a rotation of corn, wheat, peas, was 19.1 bushels per acre, as compared to 8.9 bushels

per acre on a plot that has been in wheat continuously since 1897. They point out that one of the big factors in producing such a marked difference in yield, was the difference in the amount of weeds in the two plots. That is, in the case of the continuous wheat plot, the material produced was not all wheat but much of it was wild oats. They also observed that the older the continuous wheat plot the more complete was the possession of the plot by the wild oats.

I am not well enough acquainted with the system of farming in the spring wheat area to offer any definite plan to get rid of the dockage.

Report of Project No. 401, "Threshing Machine Studies," at the University of Illinois

Reported by I. P. Blauser

Reasons for Study. Harvesting and threshing make up from 50 to 60 per cent of the operating expenses in the production of small grains. In the 1919 census, the area occupied by these crops made up 32 per cent of the improved farm land in Illinois, and yielded 208,330,000 bushels. It is evident from the data obtained by the Grain Threshing Division of the Food Administration in 1919 that there is a considerable waste of grain in threshing that can be avoided. Most threshermen can judge fairly well the quality of work they are doing, but a blanket test is necessary to determine the amount of grain being lost. A loss of less than one per cent is considered as unavoidable waste, a loss of one per cent or over poor operation, and a loss of two per cent or over wasteful operation.

Progress of Project in 1924. During the last two weeks of July and the first two weeks in August, 1924, twenty-two threshing rigs were visited, twenty of these being studied and tested. The other two operators refused to allow their machines to be tested.

Considerable difficulty was experienced this year in getting the grain out of the heads, even though a full set of concaves set clear up was used. This difficulty was due largely to the uneven ripening of the grain, which caused many immature heads. Turkey Red wheat seemed to be the hardest to get out of the heads. In several cases corrugated concave teeth were used to good advantage.

In the blanket tests, the grain recovered does not represent the total loss, because the grain still in the heads after going through the wind stacker was not recovered. The blanket tests showed a loss ranging from 0.10 per cent to 2.60 per cent for the twenty machines tested. The loss from eight of these machines was over one per cent. Adjustments were made on five of these eight machines reducing the loss to less than one per cent. The loss from the other three of these eight machines was not reduced, in two cases on account of very damp grain, and in the third case rain prevented further study and tests. Two machines showing a loss of slightly less than one per cent for the first tests were adjusted reducing the loss to about one-half that amount. Adjustments reducing the loss were made on seven of the twenty machines tested. The average loss for these seven machines before making adjustments was 1.43 per cent as compared to 0.72 per cent after making adjustments. These losses were due to the following conditions: poor separation caused by heavy feeding or too much speed; unthreshed heads caused by damp grain, immature heads, cylinder speed too low, loose or improperly aligned concave and cylinder teeth, or concaves set too low; grain being blown over caused by too much wind, sieve set too fine, uneven feeding, machine not set level or tailings board set too low.

Both large and small outfits were tested, and each type seems to do equally good or poor work under like conditions. However, there is a greater tendency to overfeed the smaller machine, which results in heavy losses. One small machine showed a loss of 2.40 per cent, which was reduced to 0.70 per cent by lighter feeding.

The use of basket racks shows a labor reduction of 20 per cent in getting the grain to the machine.

An Application of the "Sky Hook" Principle

By O. K. Howe

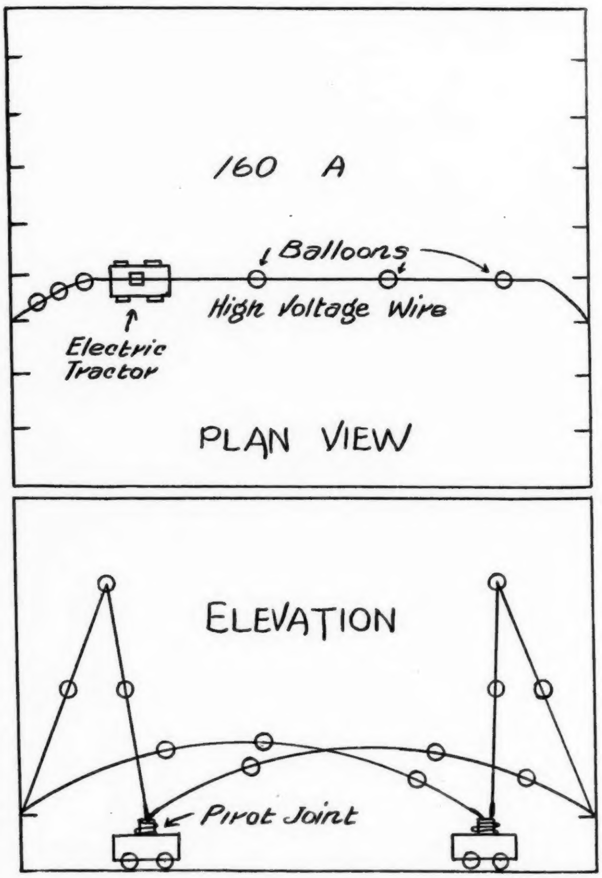
Student Member A. S. A. E. Senior student in agricultural engineering, Kansas State Agricultural College

IN connection with my thesis in rural electrification at the Kansas State Agricultural College, in developing my ideas of making the field electrical tractor more portable, I thought of an idea which may be of interest to agricultural engineers, particularly those interested in the application of electricity to agriculture. Some of the agricultural engineers with whom I have discussed it say that it cannot be worked out on a practical basis, while others say that it offers a possible solution of the feed-wire problem.

The idea is to install the transformer on the tractor itself and support the light wire, carrying the high-tension current from the line to the transformer, by means of gas balloons, as shown in the accompanying illustration. Relatively small balloons would be required to support the wire, so that the tractor could move back and forth across the field with little difficutly.

No doubt this idea would be more apt to be feasible in connection with vegetable gardening than in the less intensive phases of agriculture. For use in vegetable gardening the feed wire would not necessarily have to be very long.

All manner of tools, such as mower, weeder, and tillage tractor could be devised to operate conveniently with the electric motor. Another advantage of such equipment is that in vegetable gardening communities electricity can usually be procured at city rates.



Showing idea for supporting power line by means of balloons

Farm Structures---Maximum Results At Minimum Cost*

By Max E. Cook

Mem. A. S. A. E. Farmstead Engineer, California Redwood Association

BETTER types of buildings or improved structures of any kind are not produced by accident. Increased utility and economy in building construction are not acquired by mere chance. Successful business buildings, industrial plants, and better homes are developed as the result of much study, research and planning.

Since the farm as a business and the farm as a home will always be more or less inseparable, it becomes doubly necessary to apply the principles of good planning, good engineering, good business, and sound agricultural practice, to the efficient layout of the farmstead and the development of practical, serviceable and attractive farm buildings with suitable conveniences and accessories.

The problem of building a better home or a better structure of any kind—obtaining maximum results at minimum cost—is fundamentally the same, whether in the country or in the city. If cost of construction, maintenance and upkeep are to be given proper consideration there should be (1) a determination to avoid waste not only in the selection and disposition of the most suitable materials entering into the construction, but in the efficient layout of the plan to render it most livable and workable; (2) a conviction that it is false economy to sacrifice the essentials in honest, durable, safe and desirable construction, and (3) a desire for improved architecture of distinction and good taste.

With all the sentiment surrounding the farm home idea, the building of a successful, efficient, and attractive farmstead yet has in it more of business than sentiment.

Whether a farm owner seeks engineering advice and counsel, the worth of a well-studied, predetermined plan cannot be overestimated. To proceed without properly studied plans, and repeatedly to make changes as the work progresses usually proves costly and generally results in dissatisfaction. I am fully aware that the average farmer cannot afford to engage, at least directly, the professional services of an agricultural engineer, an architect, and a master builder, but there are nevertheless recognized channels through which he can obtain valuable assistance at little or no cost. To the extent that these channels are opened up to him, and to the degree that the agricultural engineer will contribute his best efforts toward disseminating accurate and reliable information to him through these channels he will be benefited.

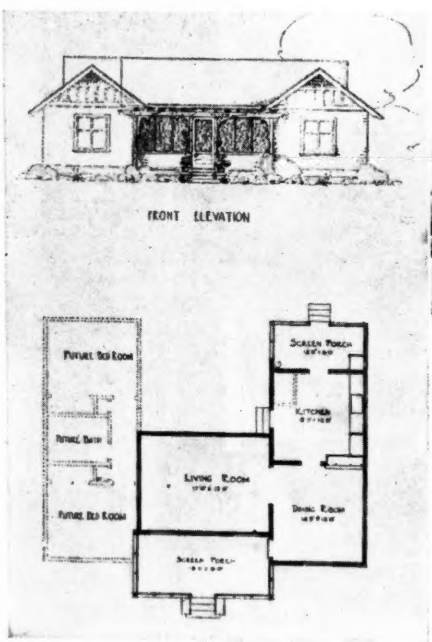
Lumber dealers, building material supply houses, and reliable builders welcome a complete set of plans and specifications from which to figure and to build.

One of the most effective ways of keeping down the cost is to eliminate waste, not only by designing to produce, within a limited space, the maximum toward home and housing requirements, but by using materials most suited and to the best advantage. The saving effected through careful design, to permit the use of standard lengths of lumber and acceptable stock patterns, alone may be sufficient to repay several times the cost of preliminary study and planning.

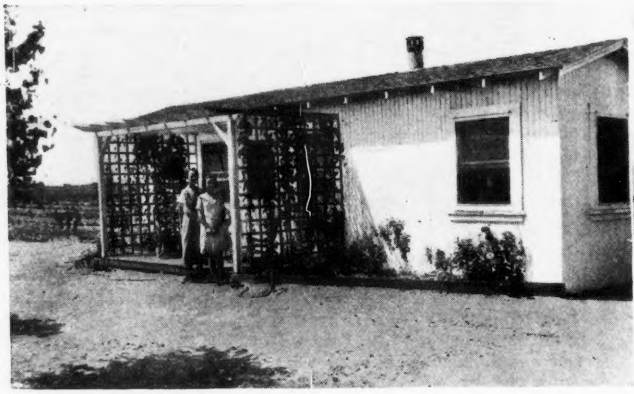
It was brought out at a recent general lumber conference on American Lumber Standards that one-third of the final lengths of lumber used in typical eastern and middle western houses were under eight feet. The practice of buying long lengths of lumber for all classes of buildings to be cut in shorter lengths before incorporating into the costruction is altogether too prevalent. By making provision for short lengths in the design and by definitely specifying short lengths a saving of both time and money can be effected.

To obtain maximum results, think of all the things that

*Paper presented at a meeting of the Pacific Coast Section of the American Society of Agricultural Engineers, Los Angeles, May 29, 1925.



(Left) This is but one plan to illustrate the possibilities of building on the unit system. The portion indicated in solid black, or even a single wing may serve satisfactorily at the outset, with the extension indicated in dotted lines added later as funds permit. (Right) This is a photograph of a house built to a plan similar to the one shown at the left. The porch was added two years after the first construction work



(Left) This 16-by-32 three-room temporary dwelling is completely equipped with doors, windows, screens, patent chimney, sash cords, weights, pulleys and hardware, all of which are suitable for installing in a $10,000 dwelling. The flood is balloon framed. All materials and equipment are readily salvable for use in a more permanent dwelling. (Right) This is a temporary dwelling designed to be converted later into a poultry house. This three-room dwelling with a front door that cost $12, with cross ventilation in the rooms, cost very little over $400, including all labor and material, with prevailing carpenter labor at $7 per day. It is to be converted at a future date, and at a minimum cost, into a poultry house

can be omitted at the outset, yet that may be added later at minimum additional expense or inconvenience.

Maximum results are obtained only where every dollar works and buys real value. It is false economy to substitute materials that may be "low priced" at the outset, yet expensive in the end. Good service represents value. Quality materials give service resulting in true economy.

The same obtains with workmanship. Knowledge, experience, and skill, in both design and construction, are required to insure a correct combination and appropriate use of materials at minimum cost.

Although the farm as a rule requires a bigger house than the city, and the farmstead must be developed ordinarily with less money available, this is offset, to some extent at least, by the fact that a farmer is often able to apply his own labor.

In undertaking to assist a farmer and his wife (who should always be included) in building a home, or in improving the farmstead, we generally find the family budget the most formidable obstacle. However, long ago I learned not to count money until after minimum requirements were determined.

This opens up three distinct and separate means by which successful farm structures may be built without sacrificing quality, yet where available funds are limited:

(1) Unit System of Building. A building may be designed with all that might be desired in size, equipment, and finish, and yet in such form that it can be built in units to suit the purse. This is a perfectly feasible plan when handled skilfully, with provision to avoid waste in making later additions and by contemplating maximum salvage possibilities. This has been done successfully and will be repeated a great deal more when it has been more fully investigated and becomes better known.

The units as they are built are complete in every sense, and at least that unit or portion of the building that is built is enjoyed to the limit, containing as it does all the features of convenience, equipment, and finish individually desired.

(2) Shell or Skeleton System. It is taken for granted that building on the unit plan would not be satisfactory where greater division and larger floor spaces are required, with still limited funds available.

Here there is but one thing to do, that is, search and research for nonessentials.. Omit only those things that can be added later with the least inconvenience, and without sacrifice to good foundation, honest framing, solid construction, durable walls and roof. In other words, build the shell or skeleton of a building, but let it be the nucleus of a better building, a permanent improvement. In this direction, some of my hardest effort has been spent in preventing home builders and farmers from attempting to "bargain" for a cheaply constructed, shoddily built structure, wherein there are no points of merit except, to the unschooled, "It looks like a whole lot of building for the money."

(3) Temporary Dwelling. Where there is insufficient money available at the outset to build according to recognized standards, either a finished unit of a permanent home, or a good house, honestly built, that may yet be incomplete as to full equipment, finish or refinements, it sometimes proves desirable to erect a building that may be occupied temporarily as a dwelling, with a plan for conversion at a later date into a utility building such as a garage, or summer kitchen, laundry, workshop, tenant house, etc.

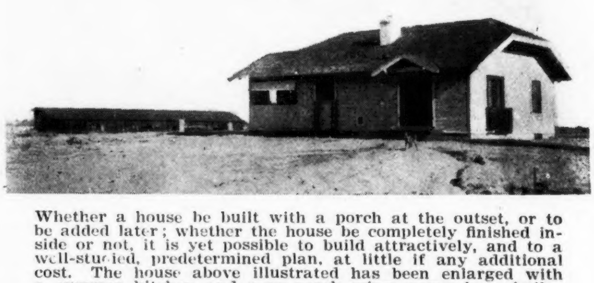
A temporary dwelling, if properly designed, can have many conveniences, and can be made attractive and very livable at a considerably smaller investment than by any other means. The dwelling proper, to be built later, should be sufficiently well in mind to permit of purchasing and incorporating into the temporary dwelling, sash, frames, doors, screens, fixtures, etc., that are permanently suitable and that may be transferred later.

These are but other ways of building on the installment plan. I have built many buildings of each of the foregoing types, not limited to houses, but including all classes of farm buildings. These methods have proven satisfactory, and in many instances the means of enabling families to own their own homes which might not have been accomplished otherwise.

I do not mean to advocate that any one of the three methods outlined will suit all demands. As a matter of fact, one assumes a big responsibility in influencing a home builder in determining his exact requirements. The human element cannot be overlooked. A family without real ambition and firmness of purpose should not be encouraged to build a temporary dwelling if there remains any doubt as to their intention and ability of carrying on toward the development of a better home later. Such a family had better rent.

The same obtains, although perhaps to a lesser degree, with the other two types mentioned.

Fundamentals — Non-Essentials. To obtain maximum results at minimum cost, we must keep in mind the fundamentals of good sound construction. We must exercise



Whether a house be built with a porch at the outset, or to be added later; whether the house be completely finished inside or not, it is yet possible to build attractively, and to a well-studied, predetermined plan, at little if any additional cost. The house above illustrated has been enlarged with a summer kitchen and rear porch wing, somewhat similar in lines to the front porch

common sense, uncommonly well. It is false economy to attempt to save by using inferior materials, poorly installed.

The non-essentials must first be weeded out. Things that may be added later at the least additional expense may well be omitted at the outset.

(1) Foundation. Starting at the foundation, it would seem unnecessary to advocate concrete or masonry for the foundation of a permanent building. For sills on the masonry and wherever necessary to place wood in contact with the ground, a rot-resistant wood only should be used. White oak is rated by the U. S. Forest Products Laboratory as one hundred per cent durable, Western red cedar, bald cypress and California redwood rank one hundred and twenty-five to one hundred and seventy-five per cent by the same authority.

(2) Frame. Sound framing should, under no circumstances, be sacrificed since this all-important part of a building is more or less inaccessible for later repairs and is the very backbone of the structure.

All timbers should be of suitable grade and of adequate size and spacing to insure rigid construction. Suitable bracing, insect and fire stops, proper insulation to insure warmth in winter and coolness in summer should not be sacrificed.

It is foolhardy to space studding 24 inches apart and expect a thin pattern siding of any kind to span the studding without sheating and building paper, and yet give service.

The same obtains with spacing of rafters and floor joists, particularly where no sub-floor is laid, since the flooring boards cannot be expected to withstand excessive spans without rapidly depreciating.

(3) Exterior Finish. In the exterior finish of a building, quality is an important consideration. Wood has stood the test of time and it is yet, in my opinion, the most economical finish best fulfilling all requirements.

If brick, masonry, or stucco finish is desired, it is only true economy to demand the best. A material should only be selected that has proven its worth, and that embodies all the good qualities of a well-chosen wood siding; qualities, in both material and installation, of low initial cost, continued resistance to the elements, durability, insulating value, ease with which alterations may be made, and low cost of upkeep, yet maintaining at all times a sanitary, snug and cheerful housing, both from within as well as in its exterior appearance.

Wood is a material with which farmers are familiar. Its use is based on innate qualities, and being easy to handle and work it is the farmer's favorite.

Builders of wood can point to numberless instances of wooden siding on buildings which has given good service for fifty years or more, and to many cases of durability of more than one hundred years.

The use of wood construction and finish makes possible enlargement or remodeling at minimum cost and, after all, this is an important consideration since it may be said that may of our buildings are never finished. Very few indeed so-called permanent buildings ever survive obsolescence. Well-built lumber construction, if given the same care as other more expensive types, will last the lifetime of several generations of occupants.

(4) Equipment. The electric wiring installation in modern farm buildings should not be sacrificed to keep down the cost. It would be far better to select cheaper fixtures that might easily be replaced later with more acceptable ones, than to omit important switches and convenience outlets for labor saving devices. With electricity as the modern helper on the farm, these are primary considerations.

Without intimating that a lifetime's convenience and accessibility should be sacrificed by centralizing the various plumbing outlets and fixtures, nevertheless a carefully studied plumbing layout may result in a genuine saving in cost of installation. Certain roughing in may be done to provide for fixtures to be installed later.

Without disregard for accepted plumbing practices, it is yet possible to decrease materially the cost of plumbing systems without sacrifice to convenience or operation.

Recent experiments by the Department of Commerce in Washington proved that plumbing cost for the ordinary dwelling alone may be decreased fifty per cent by using a minimum piping.

(5) Farmstead Layout. Maximum results are not obtained where the layout of the farmstead is not given every consideration.

Location, elevation, drainage, prevailing winds, outlook, proximity to highway, neighbors and community center, orientation of buildings and relationship to one another to save steps and facilitate operations must all be regarded.

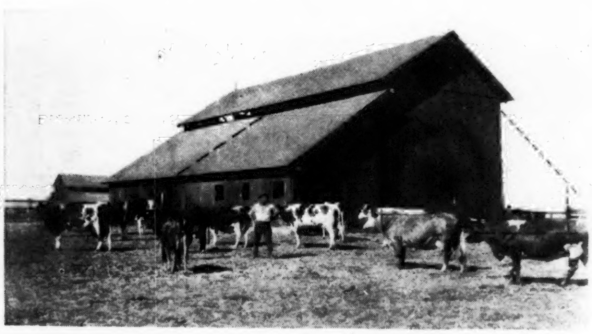
To be efficient the farmstead should be laid out with the same forethought and care that is given to even the smallest of our industrial plants.

The Agricultural Engineers' Duty. As agricultural engineers we are not all necessarily specializing in farm buildings. Few of us indeed can look forward to an opportunity to concentrate our efforts to this field. But those of us who do can at least expect your moral support and ask that you help us spread our gospel.

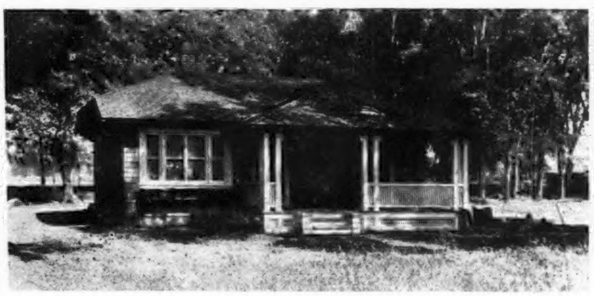
One reason so many farm buildings go up unplanned, poorly built and uneconomical, at least in the end, is because of the lack of knowledge of how to proceed.

Much is to be accomplished, first in arousing the farmer's interest, in demonstrating to him the value of a paper plan and the superiority of a planned structure and an organized building development. We must adopt more initiative in leading the way and at least bring to his attention the various sources of supply for reliable information that will assist him with his farm building problems.

The day may be far ahead when a farmer may be expected to pay for such services and be the gainer thereby, but it nevertheless is coming. In the meantime he should be encouraged to take greater advantage of the valuable yet free guidance of authorities and agencies.



The lean-to barn wing in the immediate foreground served for over a year as an all-purpose barn, leaving the owner free to extend or enlarge in any of the ways indicated. The boards on the high side of the original wing were utilized without waste in the extension



This illustration indicates a house built on the shell or skeleton system. This picture was taken but a few days after completion of the entire exterior, with all necessary framing to permit of finishing the interior later. In the form illustrated and described, this house, which is 26-by-40 feet, was built sturdily and finished properly on the entire exterior for approximately $1200. Today, due to interior finish and conveniences installed from time to time by the owner, it is probably worth close to $3000

The Relation of the Agricultural Engineer to Land Economics*

By R. T. Ely and G. S. Wehrwein

The Institute for Research in Land Economics and Public Utilities

THE relationship implied in the title of this address is mutual; the land economist is distinctly related to the engineer, the farmer and the business man. The land economist is not a swivel chair worker, nor is his laboratory in some room full of test tubes or intricate apparatus, but his work shop is in the whole field of human relations and reactions arising out of man's relation to the land. If he is a real economist he will follow the advice of one of the oldest scientists in our profession, Richard Jones, who said, "Look and see." The land economist must not get away from nature, physical phenomena and mankind; if he does he become a mere theorist.

Let me give you an illustration of how we learn from the soil scientist and engineer. Ricardo used the phrase "the indestructible powers of the soil." Economists have debated this phrase pro and con and many have denied that the soil has powers which are indestructible. A student of ours with a background of soil science analyzed the structure of the soil and noted that there were certain elements such as texture, humus content, and others which for all practical purposes were indestructible and unchangeable by man while a relatively few elements are depletable and restorable by man. This we consider a real contribution to the subject.

It might interest you to know that one of our graduate students is working jointly with the Institute for Research in Land Economics and Public Utilities and the department of agricultural engineering of the University of Wisconsin. His subject is land settlement, the physical and economic factors which influence the rate and progress of the settler on our cut-over lands.

However, the engineer is constantly confronted by the economic side of his problem. In fact, the step from engineering to economics seems to be a natural one. Some men in high position dealing with economic questions have been trained in engineering. Herbert Hoover is an outstanding example, and so is Dr. Elwood Mead. Mead began as an engineer in the irrigation work in Utah, as you know, and is now at the head of the U. S. D. A. Reclamation Bureau at Washington. The success of his bureau depends entirely upon the soundness of his decisions on the economic side. It is a well known fact that the engineer's job in reclamation has been excellent; it was not faulty construction or dishonest work that has caused the difficulty in reclamation but the failure to apply economics to the enterprise.

Engineers Problems Largely Economic

Our Institute is a subscriber to the "National Reclamation Magazine" and as we look over the files we note how often the reclamation engineer has to grapple with economic problems. There are articles on drainage assessments. Here you are involved in valuing the land, the benefits received by the land and the charges to be borne by each land owner. All this is economics and not engineering. Financing is another problem and we note an article, "Wanted, a Drainage and Irrigation Byllesby," a proposal that some big company get behind reclamation and get it on its feet. Another article deals with the appraisal of drainage districts, or rather the valuation of the land in such districts. Land valuation and appraisal are the heart and soul of land economics and as yet we are at the threshold of attempts to work out principles and rules whereby we can proceed in a scientific manner in this field. More has been accomplished in urban land than in agricultural land in the field of valuation and the multiplicity of methods and rules used by various appraisers is bewildering to the uninitiated. If the valuation of agricultural land is difficult, the valuation of unreclaimed swamp land is doubly so.

Perhaps I have given enough examples to show that the economist and technical man must work hand in hand. The one working without the other's experience and advice will fall into error. Allow me, therefore, in the rest of this paper to call your attention to one or two phases of land economics which are of interest to the agricultural engineer who is working with the reclamation of land.

The land economist is thinking in terms of a land policy. This, in brief, means that the natural resources of the nation are to be conserved and utilized according to a definite plan. Such a plan must be comprehensive enough to include not only agricultural land, but also mineral land, forests, recreational land, water resources and even urban land. Truly a large order! For the present we will consider only agricultural land and such other lands as compete with or are involved in the expansion and utilization of farm lands.

How Fast Shall We Proceed in Reclamation?

The great question before those interested in reclamation is how fast shall we proceed? There is no need to bring more land into agricultural use unless there is a demand for the products of the soil. The demand will depend upon the growth of population at home and abroad and upon the buying power of the population. There is little hope of completely reestablishing our foreign market; every European nation is making efforts to become self-sustaining. Besides, Australia, Argentina, Canada and New Zealand are great rivals of ours in producing the staple agricultural products.

But it is contended that our home population is growing rapidly. However, the rate of population growth has been falling. The native-born birth rate has been declining since 1810 and the birth rate among foreign-born peoples falls rapidly in the second generation. The present immigration law is holding back the fecund foreign groups. The need for more food producers is growing less, relatively speaking.

Secondly, the invention of machinery and the improvement in agricultural technique—largely the result of the work of the agricultural engineer—have increased agricultural production per man and per acre. This again slows down the demand for more farmers and more farm land. Sir Daniel Hall says that in a country that is self-sustaining only 10 per cent of the people are needed to feed the nation.[1]

Forecasts of population indicate that there will be about 150 million people in the United States by 1950. This is only 25 years hence but a long enough period to affect the present and next generation of farmers. The United States Department of Agriculture has estimated that with only a moderate change in our consumption habits and a slight increase in the productivity of our soils this population increase can be supported by an addition of only 40 million acres of crop land and improved pasture. During the war we added 45 million acres to our crop land, so this addition of 40 million acres spread over 25 years will not be a great task, especially if

*Paper presented at the nineteenth annual meeting of the American Society of Agricultural Engineers, Madison, Wisconsin, June, 1925.

[1]Sir A. Daniel Hall, "Feeding the World", in Atlantic Monthly, May 1925, p. 683.

we consider the fact that there are 400 million acres of potential arable land to chose from, that is, ranch land, irrigable, drainable, forest, and cut-over land.[2]

The conclusion of the Department of Agriculture is "In view of these possibilities it would seem hardly necessary to reclaim a large area by irrigation or drainage for the expansion of agriculture during the next few decades, and certainly there would be no justification in undertaking such reclamation, except in the case of projects where the economy of reclamation could be demonstrated inequivocably".[3]

Our past land policies have neglected entirely the relation between population and the supply of arable land. Settlement was pushed far beyond the food needs of the nation. We swamped the East and Europe with food at bargain counter prices at the expense of the farmers. Marketing reform and cooperative marketing are hailed as panaceas, but have their limitations. Even the "eat more" campaigns cannot expand the internal capacity of our consumers. If you eat more wheat, you must eat fewer potatoes; if you buy of one farmer, you bring distress to another.

Why is it that we have not realized that over-development of agriculture will inevitably bring over-production? I thing that part of the explanation lies in our conception of agriculture as an industry. It is a trite saying now-a-days that "farming is a business," but the truth is we do not treat it as such. We are treating agriculture as if it were still in the self-sufficing stage when every farm produced and consumed most of its products at home. Then every farm was a unit and did not compete with other farms to the extent that now obtains. But the modern farmer is producing mainly for the market, and it is out of the surplus over and above his cost of living that he supplies himself with the comforts and luxuries of life, his automobile, radio, electric lights or even the more necessary things such as furniture, bathrooms and reading matter. In fact it is out of this surplus that he must pay for his land, his equipment, and the costs of drainage and irrigation.

Farming Is Essentially a Competitive Business

Some writers emphasize the farm as a "home" and farming as a "mode of life." They want the farmer to go back to a kind of self-sufficient state of peasant farming. To suggest this is to turn the clock backwards. The American farmer will never be satisled with a peasant's existence. The most successful farmers of Europe are without doubt the Danes who practice a highly commercial agriculture by producing for the foreign market and an urban market within their own country. And nowhere in Europe will one find the culture, comforts and conveniences among the rural people such as the Danish farmers enjoy.

The farmer as a business man is in a competitive business. There is no monopoly among farmers nor will there be. In any competitive business there will be overproduction if you have too many people in the business; in fact overproduction is an indication of this condition. To speak of underconsumption is begging the question; the result is the same for the producer. Our past land policies have induced as many people as possible to enter farming and we are still at the same game. Somehow we have made the farmers themselves believe the more competition they have the better they are off. By teaching better production in our schools we have made each farmer a more efficient producer and a sharper competitor than before; and this is as it should be. But the federal government, state immigration departments, and private agencies are all on the job to persuade more people to become farmers and get the "man-hungry" acres into use. This propaganda is often at the taxpayer's expense and is a costly business. It has cost Canada as high as $1,000 to "capture" a single settler. In California it has cost as much as $200 an acre, and generally speaking it costs one-fourth of the selling price of the land.[4] When we reach the "starvation point" this will no longer be necessary; men will be glad to seek the land; now the land seeks the man.

The United States Census reveals some interesting things in the trend in land utilization in the decade 1910-1920, which are highly significant if one remembers that we were in a great war where the slogan was "More Food—Food Will Win the War." The census was taken at the end of 1919 before the depression had a chance to remove the effect of this war expansion.

Almost every state east of the Mississippi decreased its land in farms and many of them decreased the area of improved land. It is estimated that 1,000,000 acres of farm land reverted to brush and forest annually throughout the East in this decade. Only in the West was there an increase in farm land because of the grazing homestead acts, but a relatively small increase in improved land.[5]

This slackening in the demand for land in spite of the war pressure for food is shown in the condition of the reclaimed land. About two-thirds of the land in drainage projects was improved in 1920; in the South Atlantic states it was but 16.3 per cent for the operating enterprises and only 3½ per cent for the enterprises projected but not begun.

In the irrigated sections it will take 35 years to take up the land now in enterprises at the rate of 1910-1920 development and 14 years to take up the land upon which water could be put at once if it were wanted. There was enough land drained to provide for the normal rate of expansion for about 35 years without starting any new projects.[6]

Cheaper Production Should Be the Goal

However, let me present the other side of the picture. In manufacturing we are ever striving for cheaper and cheaper production, and the manufacturer derives a profit from large sales with a varying margin, often small, between costs and sales price. The manufacturer scraps poor material and instruments and is always looking for better material, instruments, and processes. It is not so easy to scrap poor land, but that is something that has to be done and done on a large scale. That has already been pointed out with reference to the country as a whole. Not half of the land of the country is good farming land, and to farm it means poverty for many and often a disastrous glut in the market. Even on the individual farm it may be wise practically to let alone some of the land and put capital and labor on the better land.

Now this has application to drainage and reclamation. The fact that there may be relative overproduction does not mean that new land should not be brought into use through drainage and other kinds of reclamation. One way we make progress is by going over from poor land to good land, putting out of farm use the poorer land. There are undoubtedly cases where drainage can be carried on so that it will bring in better land and so that the cost will not make the utilization of the land, if it is brought into use, unprofitable. We believe the more you think about this, you will see how wide an application it has. Even now there may be some great projects that are worthwhile and will add to the prosperity of the country, but these should be very carefully considered before they are undertaken. Moreover, in reclamation, as elsewhere, we should always base our action upon some systematic plan of settlement and utilization. Land planning is just beginning to come into its own, and during the next generation it is going to be one of our leading land policies and give us a richer country, a more prosperous country than we could otherwise have. The ideal settlement is to have it as close and compact as possible. The closer settlement of the land is a phrase much used in New Zealand and Australia, and it is something that forms one plank in any platform of land policies.

[2]L. C. Gray et. al, "The Utilization of our Lands for Crops, Pasture and Forests", Yearbook of the U. S. Department of Agriculture, 1923, p. 495-496.

[3]L. C. Gray, op. cit. p. 497.

[4]Report of the Division of Land Settlement, Part V., Sept. 1922, p. 16.

[5]L. C. Gray et. al. pp.433-439.

[6]R. P. Teele, "Land Reclamation Policies in the United States," U. S. Dept. of Agriculture Bulletin 1257, pp. 26-30.

We should also consider the drainage on the individual farm. Tiling often is extremely profitable, yielding a large return to the individual and giving us a greater production of wealth in proportion to expenditure of capital and labor.

What we are trying to do is to make it clear that we do not engage in any wholesale condemnation of drainage or reclamation. Even now, it has its place, and in the future it is going to have a larger role to play. While we do not advocate bringing land into use in anticipation of a population growth, not yet realized, we cannot overlook the fact that, after all, population is increasing, and we do not know what the future has in store for us in this respect.

In the case of forestry we plan in anticipation of future needs, and we should have future needs clearly in mind for agriculture as well. We do not want to go so far ahead of needs for food and raw material produced by the farmer that prices will be low and that the farmer will be poor while waiting for a demand that does not as yet exist.

Let us emphasize that we fully recognize the economic truth that there is no such thing as general overproduction. There is overproduction at particular times and places, and overproduction in certain lines of endeavor. When fruit rots on the ground and nobody will gather it without cost, certainly there is overproduction. The serious problem, however, is that of disproportionate production. That is one of the things that we are struggling with now—a disproportion between agricultural production and manufacturing and the different price levels, of which we have heard so much.

This brings us to the second problem which we wish to place before you. What has just been said affects reclamation in a vital way. It is only the land that is productive and at work that can carry the costs of reclamation. Land that is idle pushes the burden on the land that is at work. Where land has to be reclaimed, then sold and the costs covered by the sales of the land, the problem becomes very complex. If there is no demand for the land, as has been the case the last few years, the promoting company is saddled with the cost of the land and the cost of reclamation. Ripening costs begin to pile up, costs which are usually underestimated. By ripening costs is meant maintenance and upkeep costs, and taxes, and interest on all outlays from land and construction costs to taxes. The company must bear these costs until the last acre is sold. No one has realized better the need of rapid settlement in order to get the land into production than has Dr. Elwood Mead, a point which he emphasizes most emphatically.

The Settler and His Problems

But we must not forget the settler and his problem. He begins with a charge for land and for the reclamation of the land. Perhaps he has to clear and prepare it for the plow. He has to put up buildings, buy his equipment, and establish his home. Community improvements such as highways, schools, churches, are other charges which must be met. Like the company, he has his ripening costs in the form of interest and taxes. "The cost of reclamation is but one item and not always the largest one to be charged against improved land".[7] All these charges must be paid out of the products of the land; there is no other source of income unless the settler has other occupations, and few of them have. The failures of settlers for these and other reasons are so common that the cynical saying has become a by-word that it takes three crops of settlers before the last crop will "stick." This ought to condemn any settlement policy. The reclamation enterprise would be better off and the country would be filled with contented settlers, if we had a method of settlement which would get the first crop to stick. That is why Dr. Mead is proposing to use the California land settlement scheme to top off irrigation enterprises with the hope of getting settlers started right and helping them to stay.

The only way to make reclamation pay is to get the soil to produce crops of sufficient value to pay the settler his costs and leave a surplus to pay the company the reclamation costs. That income must overbalance land utilization costs is a simple principle which is not easy to apply. To get the soil to produce, the soil must be right. After irrigation had been tried on the reclamation projcts for about twenty years the fact finding committee reported that $27,000,000 of irrigation charges were against land which was submarginal for agriculture, and the government stands ready to write it off. Somehow one wonders why the soil was not classified first and all poor soils rejected. You will have to admit that there is much poor soil in drainage projects which cannot produce an income. It seems to me that it will not do to say that such a soil can be made a productive soil eventually, if you treat it with phosphorus, lime it, or do so and so. The settler needs production at once; if he has to doctor the only source of income he has and nurse it to health, the doctor bills may exceed the value of the land when he gets through with it.

An Alternative Use for Drainable Land

But there is an alternative use for drainable land. If such land cannot be used for farming it can be used for forests and recreational land in many cases; the two uses are usually coincident. Here we are on a delicate subject, but one which needs cool judgment and not red hot propaganda for its solution. Drainable land must not only justify reclamation by showing a profit after being reclaimed, but it must show a higher profit when in agricultural use than as forest or recreational land. This is not easy to measure in dollars and cents, but some decision must be made in conformity with a rational land policy. Many drainage projects are under fire at the present time. Our Institute has seven letters from county agents, land men, and the department of conservation of Indiana concerning the economic condition of the Kankakee marsh, and there is such a diversity of opinion as to its success that one doubts whether its drainage was advisable. One needs but to mention the Horicon Marsh and the Winneshiek Bottoms to arouse the ire of both drainage men and the Izaak Walton leaguers.

We feel that there is a place for forests and recreational land and that they will become of greater and greater significance in the future as our population becomes more congested . Recreational land is of more than sentimental value. The Chamber of Commerce of Denver reported a tourist traffic worth 44 million dollars per year for Colorado. Wisconsin estimates its annual tourist trade to bring 75 million dollars. Is not this income just as good "money" as if Colorado has sold 44 million dollars worth of wheat? It is said that Europe will eventually pay all her war debts out of the American tourists' pockets.

Forest and recreational land must be given a place in a land policy and it must be done soon. You can always drain or clear land, but it is impossible or economically impractical to reconvert land once in farms into swamps and forests.

We have taken this stand on this question: Let us classify our land on the order of the Michigan Land Economic Survey and with this inventory before us give proper place to forests and recreational land. This we believe is largely a public use, and public burdens should be publicly borne. Private property should not be asked to supply public recreation without compensation. The farmer has just as strict rights to his farm as the city dweller to his front lawn. If he is told he must not drain his land so that the public can hunt on this land, the public must pay for the privilege. The solution is to make such land public property and put it under public control and regulation.

* * *

I believe that it is possible to increase the farm income materially through more efficient organization and management of our farms. We need to have more sound business principles injected into agriculture. Many of us can more wisely utilize farm lands, labor and capital in reducing farm costs and increasing net farm incomes.—W. M. Jardine.

[7]R. P. Teele, op. cit. p. 31.

Research in Agricultural Engineering

Research activities in the agricultural-engineering field are presented under this heading by the A. S. A. E. Research Committee. Members of the Society are invited to discuss material presented, to offer suggestions for timely topics, and to prepare special articles on any phase of agricultural engineering research

Fundamental Research in Agricultural Engineering and the Purnell Bill *

By R. W. Thatcher

Director of Research, New York State College of Agriculture

I AM not an engineer. Hence, I cannot advise you as to special items of research in the various fields of engineering as applied to crop production and utilization. The best that I can do is to present a few random remarks about how this matter appeals to me from the viewpoint of an administrator.

The Purnell Act is the result of a campaign for increased federal aid for research at the state agricultural experiment stations which was begun at a meeting of a self-constituted committee of station directors which was held in Chicago five years ago. At that meeting two important aspects of the general situation with reference to this kind of federal aid to the states were developed. The first was that experiment station work is not limited by state lines, but is often nation-wide or even world-wide in its applications. For this reason it is right and proper that national funds should be used in support of such research. The second was that the federal aid, which was at that time being given, was altogether inadequate. A total of $30,000 per year was received by each station under the terms of the Hatch and Adams Acts. But since the appropriations under the latter act reached their maximum in 1912, there had been no increase in the federal funds available to the stations. In the meantime the purchasing power of the dollar had declined so greatly that these funds would not support nearly so much research work in 1920 as they did in 1912. In effect, the endowment of the stations was decreased by the decreased purchasing power of the federal funds which were available for their support.

Furthermore, the development of agriculture in the post-war period was bringing about urgent demands for investigation of problems of distribution, marketing and consumption of agricultural products; whereas the terms of the Hatch and Adams Acts limited their use to the study of problems of agricultural production. It was apparent that there was a large range of problems in the general fields of agricultural economics, rural sociology, and home economics which needed to be studied in the ways which the experiment stations had shown to be feasible and desirable.

Accordingly, it was decided to ask Congress to make provision for increased federal aid for research at the state experiment stations. A bill was prepared and introduced by Representative Purnell of Indiana. At first, it met with little interest but as the various problems became more apparent and more acute, interest increased. Finally, the Purnell Bill was reported favorably by the House Committee on Agriculture. The bill as reported was a permissive measure authorizing Congress to make additional appropriations in support of research at the state experiment stations in amounts not to exceed $10,000 each for the first year, and with annual increments of $5,000 each year until a maximum of $30,000 annually to each station was reached. This maximum amount was just equal to the amounts already available under the Hatch and Adams Acts, so that the bill if passed as then recommended would have just doubled the federal aid to the stations.

Just as the Purnell Bill was reported to the House, President Coolidge made his famous speech declaring against any further extension of federal aid to state enterprises. However, the President agreed to make an exception to this stand in the case of the experiment stations, because of the nation-wide importance of the work. He authorized the Director of the Budget to approve an appropriation of $10,000 to each state or a total of $480,000 of increased federal aid to the state experiment stations.

This was the situation when the President's Agricultural Conference, of which I am a member, came into session in January. As a result of an extended hearing and careful discussion of the whole matter, we decided that one of the most constructive acts for agricultural welfare that we could recommend would be to provide for increased federal aid for careful, unbiased investigation of the many pressing problems of agricultural production, distribution and consumption, and of country home life. Accordingly, we agreed to recommend the passage of the Purnell Bill, and to suggest that the sums to be made available under the permissive appropriation start at $20-000 for each station and increase by $10,000 annually until a maximum of $60,000 is reached. Despite the fact that this maximum amount is six times that which the President and Director of the Budget had approved for this purpose, the President accepted the recommendation of the conference and sent it forward to Congress. Congress promptly passed the bill amended to provide the larger amounts, and in its last days included an item for the first year's appropriation in the final deficiency bill which was passed and signed by the President on March 4.

Hence, we may regard the Purnell Act as an established fact. It provides for a final maximum total appropriation of $2,880,000 annually for research at the state experiment stations, or double the amounts which they are now receiving, to make a final total of $90,000 to each station from the federal treasury. In some cases this adds very largely to the funds available for research at any given station. In fact, some stations are now receiving only the $30,000 per year from the Hatch and Adams funds. In such cases, the Purnell funds, when they reach their maximum, will treble the resources of the station for research work. In other cases, as in New York, for example, where the state is already appropriating over $600,000 annually for research work in agriculture, the Purnell Act will not materially alter the situation as it now exists.

It is generally understood that the Purnell funds will be used at the outset, at least, for investigations which tend to cheapen the cost of distribution of agricultural products, or to make their use more efficient, so as to lessen the spread between the price paid to the producer and

*From an address delivered at a regular meeting of the North Atlantic Section of the American Society of Agricultural Engineers, April 10, 1925.

that paid by the ultimate consumer of these products. In later years, it may become important again to turn larger attention to efficiency in production; but just at present the major interests of the country seem to lie in the field of distribution and consumption.

Now as to the problem of the relation of the Purnell Act to research in agricultural engineering. The first question naturally is, "What type of research is suitable for support from public funds?" That is, what should be supported by funds collected by taxation from all the people? A publicly supported experiment station is different in purpose from a research laboratory in a university or one supported by an industrial corporation for the promotion of its own business interests.

It is sometimes thought that the administrative officer, or director, of an experiment station is a hindrance rather than a help in promoting research activities, except at those times when he is in position to secure additional public funds for such research. But I believe that there is laid upon him a very real task, that is, to see that the research program of his institution is so laid out that it is probable that real contributions to public welfare will come from the expenditure of public funds at his station. What, then, does such a director have the right to ask of his scientific staff? I think that the adminstrator has the right to ask of his scientists that they shall come to him with a definite understanding that their proposed research is planned and organized so as to have some probable contribution to make to public welfare. I am not an engineer. Hence, I cannot cite definite examples from your field, but I think that what I mean is clear.

In order to properly appreciate his task in this respect, one must have a clear conception of the three types of service which the agricultural colleges can properly render.

The first of these is education, the education of the farmer. As agricultural engineers, you are dealing with the application of the principles of engineering to the practice of agriculture, and there is undoubtedly a very great deal that can be done in the education of farmers in the better mechanical operation of his farm.

The second is what I call "service" activities.

I am not sure that these are the function of the experiment station. In general, I presume that they are more nearly extension work, than investigational in character. They are essentially the application of some known principle or procedure to the needs of an indvidual case.

I may be mistaken, but it seems to me that engineering work often falls in this group. Perhaps it is not true, but it has seemed to me that engineers very generally deal with individual "jobs." No matter whether it is the installation of a farm drainage system, the construction of a reclamation enterprise, the building of a railroad, the erection of a bridge, or the installation of a sewage disposal plant, the tendency is, and probably necessarily so, to deal with the task as a job, to be well done to be sure, but to be done to fit a particular need or set of conditions. Such jobs are obviously service enterprises, rather than educational or research activities; although, of course, there may be some experimental aspects to certain particular undertakings.

The third type of enterprise is that which is called research, or investigation. This is the one on which I have to pass judgment as an administrator. What, then, is a research enterprise? There are limitations to the application of any definition. But in general, I should define research as being concerned with the study of a principle rather than with the application of known principles to some special need. Research involves the use of the experimental method. My definition of the experimental method is that it involves the collection of data in such a way that the observed effects can be definitely attributed to some determined cause, followed by deductions as to the governing principle of law which is illustrated in the set of observations made. It is a little difficult to carry these empirical definitions into every field of research activity. But I think that it is clear that I regard as legitimate research work any proposal which has for its object the establishing of a principle which will be applicable to all similar problems elsewhere, rather than the mere solution of a specific single problem of operation.

In certain fields of science, such as chemistry, physics, botany, etc., this has long been recognized as the research method. But in the applied industry fields, such as animal husbandry, dairying, pomology, agronomy, agricultural engineering, etc., it has not been so generally recognized. In these latter fields, the question of how to do a specific task has often overshadowed the determination of why it should be so done. But the answer to the question how is often to be found in the realm of practical experience, and the why of the matter is the contribution which scientific investigation can make. Hence, we organize our research staffs on the basis of scientific training rather than that of practical experience. The latter is, of course, a most valuable adjunct to the training of an investigator, but his most important asset is his training in the scientific method of study.

Now, as applied to agricultural engineering, I believe that all this means that the administrative officer has the right to ask that his engineering staff shall bring to him a program of research which is designed to contribute to the knowledge of the whole people those principles upon which a proper application of mechanics, heat, light, electricity, etc., can be made in the operations of agriculture; rather than the proposal of a series of service "jobs" for individual farmers or groups.

There is not time to develop this idea in detail, but speaking in general terms, I think that the task before any such group of agricultural engineers as this, so far as your research program is concerned, is first of all a kind of "job analysis." That is, an effort to find what is needed in the way of research in the field of engineering as applied to agriculture. What I should hope is that, if you organize a section of agricultural engineers in the North Atlantic states, you will first of all try to show what you believe it is possible for research in your field to accomplish in the improvement of agricultural welfare. It does not satisfy me to have brought to me a series of special "jobs"; unless these can be shown to be so organized and conducted that in the end some definite principle has been established which will make it possible in the future for the individual farmer to understand and apply this principle in practice. You see that this is just the opposite of the so-called "professional" attitude which seeks to reserve its field and findings exclusively to the members of the profession.

I do think that you have a right to go to your director of extension work and arrange with him for the carrying on of field educational and service work. But I think that your present opportunity in research is to bring to the director of research a program showing what you believe to be the possibilities for research contributions to agricultural welfare from the standpoint of engineering. Your opportunity, as I see it, is to survey the field and to say what you believe would be a satisfactory program for research at an agricultural engineering experiment station. I cannot offer much in the way of suggestion as to what that program should contain; but I may perhaps venture certain sugestions as to how one may go about it to prepare such a program.

In the first place, there are two different viewpoints from which one may start to consider such a problem. From one of these, one may ask what are the engineering problems involved in the different phases of agriculture; that is, what engineering features of soil tillage, land drainage, etc? If it were possible to do so, I should like to see the results of a "job analysis" of the engineering problems involved in the growing of a crop of apples, for example. From the other viewpoint, the investigator will attempt to organize and classify his problems into those which arise from the various engineering sciences. That is, he will ask what problems there are in the application of mechanics to agriculture; of sanitation engineering; of electrical engineering, etc.

As to which of these two lines of approach to the program of research in agricultural engineering is likely to

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Agricultural Engineering Digest

A review of current literature on agricultural engineering by R. W. Trullinger, specialist in rural engineering, Office of Experiment Stations, U. S. Department of Agriculture

Hedge and Stump Clearing Devices, B. J. Owen and H. G. Richardson ([Great Britain] Ministry of Agriculture and Fisheries, Miscellaneous Publications, London, No. 35 (1923), pp. 55, pls. 6, figs. 2).—This is the second edition of this report which deals with tests of hedge and stump clearing devices. Assuming that no initial outlay was necessary for tools, it was found that the work done with hand tools was efficient but that the method was laborious and slow, and was too expensive and too slow to be recommended for clearing a large area.

Tests of 5 and 10-ton timber jacks showed that the actual movement of the jack was relatively small and was liable to be partly absorbed in overcoming the resilience of the tree and of the ground. This device compared unfavorably with others, and it appeared unlikely that it can be used economically for work of this character.

In tests of a vertical pull stump extractor it was shown that this machine compared favorably as regards cost with other devices. It was found, however, that a large amount of earth adhered to the roots, although the roots were pulled out intact as contrasted with methods which require a sudden extraction with a tendency to leave broken roots in the ground. This machine appeared to be suitable for use by a farmer having a considerable number of stumps to clear but who is unable to spend a long time uninterruptedly on the work.

Tests of a triple horse stump puller of 300,000 pounds estimated maximum extracting power showed it to be one of the most rapid in operation for the extraction of small stumps. Owing to the necessity of hitching the cable near the ground to permit horses to step over it, it was impossible to take advantage of the extra leverage which would be obtained by hitching the cable higher. It is concluded that this machine was efficient and might be used economically in dealing with considerable areas of timber where it is undesirable to use explosives or where heavy manual labor is an objection.

Steam tractors gave results in stump pulling comparing favorably with those from other mechanical devices, although the stumps extracted were relatively small. A great deal of hand grubbing was necessary in the case of larger stumps. Tests of a steam plowing engine on larger stumps indicated the necessity for considerable hand grubbing, as did those of an ordinary motor tractor on shollow rooted stumps, which accounts for a high cost per cubic foot of stump removed.

Ordinary farmers' dynamite, while giving a high average cost per stump, gave a low average cost in terms of cubic feet of stump removed. It was also possible to remove large stumps which were beyond the capacity of ordinary mechanical devices. Tests of liquid air indicated the possibility of using this material as a stump blowing explosive, and incidentally of quite materially reducing costs. The method of operation, however, is not so rapid as with other explosives, and the radius of the use of liquid air is restricted to a short distance from the producing plant. Explosives were found to be the most advantageous from the standpoint of handling and treatment of timber after removal.

It is to be noted that all of this work has been based upon the removal of stumps in terms of cubic feet of volume. Methods for computing the volume of stumps of different shapes are outlined.

The 1921 Test Paint Fence, W. T. Pearce and A. N. Loudon (North Dakota State Food Commissioner and Chemistry Bulletin 8 (1925), pp. 1-44, fig. 1).—Continuing previous fork the results obtained with the 1921 test paint fence are presented.

These are said to be in rather good agreement with the data obtained for the 1915 test fence after a similar period of exposure. The chief difference noted between the data for the two fences is that the paints containing rather high percentages of inert pigments such as asbestine and barites are showing much greater durability on the 1921 fence than on the 1915 fence.

Materials of Construction, H. E. Pulver (New York and London: McGraw-Hill Book Co., Inc., 1922, pp. XVIII—318, figs 116).—This is one of the Engineering Education Series prepared for the extension division of the University of Wisconsin. It contains chapters on plasters and natural cements, limes and lime mortars, Portland cement, Portland cement mortars, plain concrete, building stone, brick and other clay products, stone and brick masonry, timber, pig iron, cast iron, wrought iron, steel, special steels and corrosion of iron and steel, nonferrus metals and their alloys, and some miscellaneons materials.

Base Exchange in Ground Water by Silicates as Illustrated in Montana, B. C.Renick (U. S. Geological Survey, Water-Supply Paper 520-D (1924), pp. II+53-72, pls. 3, fig. 1).—Studies of ground water in an area of Lance and Fort Union formations in east-central Montana in the Great Plains province are summarized.

The results showed that near the surface the water is relatively high in calcium and magnesium, which, with increasing depth, are exchanged for sodium and perhaps potassium, the result being a natural softening. The minerals of the leverrierite group, which are plentiful though disseminated in these formations and are believed to be derived from the decomposition in place of the glassy constituents of rock fragments, are considered to be the principal agents in effecting this exchange of bases, although the exchange may be aided by such minerals as kaolinite, feldspar, and mica. This exchange of bases is accomplished at a depth of 125 feet or less. There is no tendency for the water to acquire more dissolved material with increasing depth. The amount of total dissolved solids is therefore determined relatively near the surface.

Power for the Farm from Small Streams, A. M. Daniels, C. E. Seitz, and J. C. Glenn (U. S. Department of Agriculture, Farmers' Bulletin 1430 (1925), pp. II—36, figs. 40).—This bulletin, prepared under a cooperative agreement between the U. S. Department of Agriculture Bureau of Public Roads and the Virginia Polytechnic Institute, presents data from a survey, the purpose of which is to acquaint farmers with the possibilities of developing the power of small streams by converting it into electrical energy and with the uses to which such power can be put. In addition, information is given to enable them to avoid unnecessary expenditures, to explain how to determine the power a stream will supply, and to indicate the sources from which to secure additional information in regard to the approximate cost of installing a plant suited to the power available.

Cost of Rural Electrification, M. L. Cooke (Electrical World, 85 (1925), No. 15, pp. 765, 766, figs. 3).—Data from the Giant Power Survey in Pennsylvania are briefly presented and discussed.

It is stated that estimates have been obtained for a mile of rural distribution line of from $800 up. It is assumed that $1,200 per mile is a good average where construction is carried on on a large scale. With this in view, the data presented indicate that to reach 750,000 additional population in rural and semirural areas, of which 325,000 would be straight farm population, the cost would be roughly from $25,000,000 to $30,000,000. Such a program extended over, say, 10 years would mean an annual expenditure of about 3 per cent of the present annual capital expenditures in Pennsylvania.

On Abundance and Diversity in the Protozoan Fauna of a Sewage "Filter," W. J. Crozier (Science, 58 (1923), No. 1508, pp. 424, 425, figs. 2.)—Studies conducted at the New Jersey Experiment Stations are reported which showed that in the film of organisms and debris retained among the broken stones of a sewage purification filter, ciliate and rhizopod protozoans showed seasonal variation in abundance of individuals and a directly correlated fluctuation in diversity of their types. An inverse correlation was recognized in natural environments of greater selective stringency. It is thought that such relationships may provide a basis for comparing the selective potentials of different environments.

Seeding of Winter Wheat with Furrow Drill and Ordinary Drill, A. F. Bracken (Utah Station Bulletin 192 (1925), p. 23.)—It is reported that in these tests nitrate accumulation is directly correlated with the moisture content. Any tillage which tends to conserve moisture such as fall or early spring plowing followed by normal summer cultivation is said to also stimulate nitrate formation. Barnyard manure added to plats receiving normal tillage stimulate nitrate accumulation.

A Study of Threshing Losses from Different Types of Harvester-Threshers and Headers and Threshers on the Nephi-Levan Ridge, A. F. Bracken (Utah Station Bulletin 192 (1925), p 23.)—Tests of threshing losses from about twelve harvester-threshers showed that the losses varied from about 4 pounds to nearly 20 pounds per acre for the harvester-threshers. This is considered to be a surprisingly low loss. In most cases the loss from the headers equaled the loss from the combines and in addition the stationary gave a loss of about 1.75 per cent.

Book Review

The Buyer's Guide (Vol. XXXIV—1925 edition) is a classified directory of manufacturers of farm and garden implements, tractors, wagons and carriages, motor trucks, lighting plants, cream separators, gasoline engines, windmills, pumps, wire fencing, and the many accessory lines sold by farm-equipment dealers. The greater part of the directory is devoted to implement, vehicle, tractor, and repair classifications arranged alphabetically by machine. This classification is supplemented by an index to the classification. In addition there is a list of farm-equipment manufacturers, with their addresses, arranged alphabetically. There is also a general directory of manufacturers which includes their full line, branch houses, jobbers, etc., and there is also a general directory of jobbers and branch houses with the manufacturers they represent.

This directory is probably one of the most complete of its kind and the present edition, which recently came off the press, has been entirely revised and brought up to date. This directory is issued annually by the Farm Implement News Company, publishers of "Farm Implement News," 431 S. Dearborn St., Chicago.

Fundamental Research in Agricultural Engineering and the Purnell Bill

(Continued from Page 192)

give the most satisfactory results, I should like to offer the experience which we have had in other fields of experiment station work. More than twenty years ago, the directors of the North Atlantic states experiment stations organized for the study of the program of research at these stations. This group attempted to work out a program of agricultural research work for the region in question. The problem was attacked by appointing a series of referees to report on the research work in botany, chemistry, bacteriology, genetics, horticulture, animal husbandry, etc; that is from the standpoint of the sciences or the administrative departments concerned. Nothing constructive came of the movement. But later it was decided to appoint instead referees on the needs of research in special phases of agriculture, such as vegetable production, fruit production, dairying, meat production, forestry, poultry, etc. Now, it is possible for the referee to discover and report upon the adequacy of the research program to meet the needs of the industry concerned, and progress toward the development of a well-rounded program is being made.

Hence, my impression is that a better program of research in agricultural engineering can be worked up from the viewpoint of the needs of agriculture than from that of the subdivisions of the field of engineering. Can you think in these terms? If you can think only in terms of engineering, you will divide your program into work in mechanics, in electricity, in sanitation, etc. But from our standpoint, we would be much better satisfied if you would try to present a program which would show what you feel that you can do in adding to our fundamental knowledge of how better mechanical principles can be applied in producing livestock, growing field crops, spraying orchards, tilling soil, draining land, etc.

I am not sure that the passage of the Purnell Act is of any special significance with reference to research in agricultural engineering. But this is a critical time for agricultural research in general. The passage of the Purnell Bill has directed attention anew to the work of the experiment stations. It is probably for us to say what we believe the contributions of these stations to general public welfare can be. But we will be judged by results rather than by statements of opinion. Hence, it is of utmost importance that our program making at this time shall be as wisely done as is humanly possible. We shall have to demonstrate, in the next ten years, what science can contribute to agricultural welfare in the three fields of production, distribution and consumption of farm products. I sincerely hope that in this task, the agricultural engineers will assume their full share.

NOTE: Following the foregoing address, the chairman of the A. S. A. E. Research Committee explained that Dr. Thatcher had expressed in a few well-chosen words the thought that the Committee had been trying to impress upon all members of the Society. In other words, to be real research, a particular problem must deal with the fundamentals.

A. S. A. E. Employment Service

This service, conducted by the American Society of Agricultural Engineers, appears regularly in each issue of Agricultural Engineering. Members of the Society in good standing will be listed in the published notices of the "Men Available" section. Non-members as well as members, are privileged to use the "Positions Available" section. Copy for notices should be in the Secretary's hands by the 20th of the month preceding date of issue. The form of notice should be such that the initial words indicate the classification. No charge will be made for this service.

Men Available

AGRICULTURAL ENGINEER open for position as sales engineer, salesman, advertising writer, or agricultural propagandist. Past experience with large agricultural firms. MA-124.

AGRICULTURAL ENGINEER, 1925 graduate of Kansas State Agricultural College, with farm experience, would like permanent employment at once, preferably with a farm-machinery manufacturer. MA-126.

AGRICULTURAL ENGINEER, graduate of Iowa State College, E. E. 1909, A. E. 1910, desires to make change. Ten years experience in field and factory on tractors, trucks, and farm machinery. Five years teaching experience in agricultural engineering and farm mechanics. Instructional work along agricultural engineering lines preferred. MA-126.

Positions Open

AGRICULTURAL ENGINEER to teach farm buildings, agricultural drawing, rural architecture, and to handle the extension work in farm buildings is needed at Virginia Polytechnic Institute, Blacksburg, Virginia. The work is so arranged that one-half time will be devoted to resident instruction and the other half to extension work. Most of the extension work at present is confined to actual designing of farm structures with some field work. A man is wanted who is capable of developing the extension phase of the work to the highest efficiency. Those interested should write C. E. Sietz, head of the department of agricultural engineering.

SALES ENGINEERS (two) with engineering training wanted to sell retail Fordson industrial tractors in and around the city of Chicago. Ability to recognize a live prospect and to approach factory superintendents, traffic managers, contractors, and business executives is required. Salary to start $50 per week plus 2 per cent commission. Address G. M. Duncomb, c/o Dealers' Equipment Co., 3673 So. Michigan Ave., Chicago.

It requires but two men to operate this combined harvester-thresher outfit. The "combine" cuts about 20 cents from the cost of producing a bushel of wheat